Errata for SAM Photovoltaic Model Technical Reference

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Monday 14th December, 2015

This document lists errors with corrections for the SAM photovoltaic reference manual available from the link at the bottom of this page or from the Performance Model Documentation page on the SAM website.

Gilman, P.; (2015) “SAM Photovoltaic Model Technical Reference." TP-6A20-64102. Golden, CO: National Renewable Energy Laboratory.

Section 4.2: Sun Angles

In **Equation 4.18**, the final condition should be $a < -1$ instead of $a < 1$.

Correct:

$$a = \sin\delta \sin\left(\frac{\pi}{180} lat\right) + \cos\delta \cos\left(\frac{\pi}{180} lat\right) \cos HA$$

$$\alpha_0 = \begin{cases} \arcsin a & \text{if } -1 \leq a \leq 1 \\ \frac{\pi}{2} & \text{if } a > 1 \\ -\frac{\pi}{2} & \text{if } a < -1 \end{cases}$$

Incorrect:

$$a = \sin\delta \sin\left(\frac{\pi}{180} lat\right) + \cos\delta \cos\left(\frac{\pi}{180} lat\right) \cos HA$$

$$\alpha_0 = \begin{cases} \arcsin a & \text{if } -1 \leq a \leq 1 \\ \frac{\pi}{2} & \text{if } a > 1 \\ -\frac{\pi}{2} & \text{if } a < 1 \end{cases}$$

Section 8.6: Beam Self-shading DC Loss Factor

The symbol for the submodule **fill factor** variable is inconsistent. It should be F_{fill} instead of FF_0.

Equation 8.23 uses m_d for the number of bypass diodes instead of d. Note that the number of bypass diodes is fixed at $d = 3$, as expained in Section 8.1.

Correct:

$$F_{dc1} = 1 - C_1 S^2 - C_2 S$$

$$F_{dc2} = \begin{cases} \dfrac{X - S\left(1 + 0.5 d V_{mp}^{-1}\right)}{X} & \text{if } X > 0 \\ 0 & \text{if } X = 0 \end{cases}$$

$$F_{dc3} = C_3 (S - 1) + R_{dt}$$

Incorrect:

$$F_{dc1} = 1 - C_1 S^2 - C_2 S$$

$$F_{dc2} = \begin{cases} \dfrac{X - S\left(1 + 0.5 m_d V_{mp}^{-1}\right)}{X} & \text{if } X > 0 \\ 0 & \text{if } X = 0 \end{cases}$$

$$F_{dc3} = C_3 (S - 1) + R_{dt}$$

Section 9.4: Sandia Module Model

Equation 9.5 for effective irradiance is missing brackets to show the correct order of multiplication and addition.

Correct:

$$E_e = \frac{I_{sc}}{I_{sc,ref}\left[1+\alpha_{sc,ref}(T_c-25)\right]}$$

Incorrect:

$$E_e = \frac{I_{sc}}{I_{sc,ref}\ 1+\alpha_{sc,ref}(T_c-25)}$$

Equation 9.6 is also missing brackets:

Correct:

$$I_{mp} = I_{mp,ref}(C_0E_e + C_1E_e^2)\left[1+\alpha_{sc,ref}(T_c-25)\right]$$

Incorrect:

$$I_{mp} = I_{mp,ref}(C_0E_e + C_1E_e^2)\ 1+\alpha_{sc,ref}(T_c-25)$$

The equation for **open circuit voltage** is missing. It should be between Equations 9.7 and 9.8:

$$V_{oc} = V_{oc,ref} + s\,\Delta T_c \ln(E_e) + \beta_{oc}(T_c-25)$$

Equation 9.8 for voltage at maximum power uses log instead of ln. The logarithms should be natural logarithms.

Correct:

$$V_{mp} = V_{mp,ref} + C_2\ s\ \Delta T_c\ \ln(E_e) + C_3\ s\ \left[\Delta T_c \ln(E_e)\right]^2 + \beta_{mp}(T_c-25)$$

Incorrect:

$$V_{mp} = V_{mp,ref} + C_2\ s\ \Delta T_c\ \log(E_e) + C_3\ s\ \left[\Delta T_c \log(E_e)\right]^2 + \beta_{mp}(T_c-25)$$

Section 9.7: NOCT Cell Temperature Model

Equation 9.36 is missing brackets to show correct order of multiplication.

Correct:

$$T_c = T_a + \frac{G}{800}\left(T_{noct,adj}-20\right)\left(1-\frac{\eta_{ref}}{\tau\alpha}\right)\frac{9.5}{5.7+3.8v_{w,adj}}$$

Incorrect:

$$T_c = T_a + \frac{G}{800}T_{noct,adj} - 20\ 1-\frac{\eta_{ref}}{\tau\alpha}\frac{9.5}{5.7+3.8v_{w,adj}}$$

Section 11.2: Sandia Inverter Submodel

Equation 11.3 for Sandia inverter model parameters is missing closing parentheses.

Correct:

$$A = P_{dc,0}\left[1+C_1(V_{dc}-V_{dc,0})\right]$$
$$B = P_{s,0}\left[1+C_2(V_{dc}-V_{dc,0})\right]$$
$$C = C_0\left[1+C_3(V_{dc}-V_{dc,0})\right]$$

Incorrect:

$$A = P_{dc,0}\left[1 + C_1(V_{dc} - V_{dc,0}\right]$$
$$B = P_{s,0}\left[1 + C_2(V_{dc} - V_{dc,0}\right]$$
$$C = C_0\left[1 + C_3(V_{dc} - V_{dc,0}\right]$$